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(54) **SURGICAL STAPLER WITH TIMER AND FEEDBACK DISPLAY**

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See application file for complete search history.

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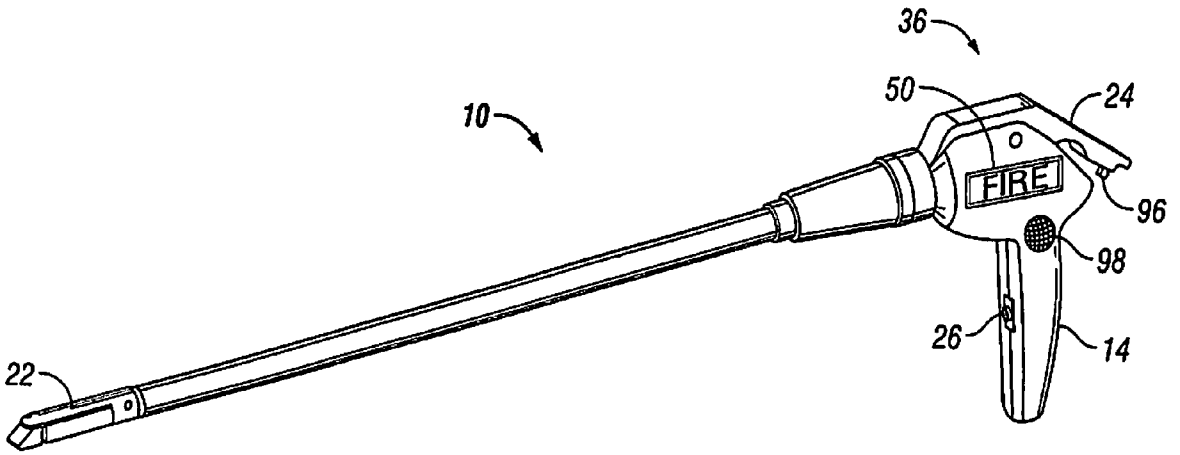
(57) **ABSTRACT**

A surgical apparatus has a clamp and a stapling mechanism. The clamp has a first jaw and a second jaw to clamp on a body tissue at a desired location for a stapling operation. The stapling mechanism is controlled by a trigger handle or a switch assembly. The surgical apparatus has a controller for providing a delay between clamping and actuating of the firing mechanism of the stapling mechanism. The delay provides for a desired amount of time for tissue compression producing a more uniform staple formation. The surgical apparatus also has an indicator. The indicator provides feedback about the status of the stapling mechanism and also displays a time of tissue compression by the clamp.

19 Claims, 15 Drawing Sheets



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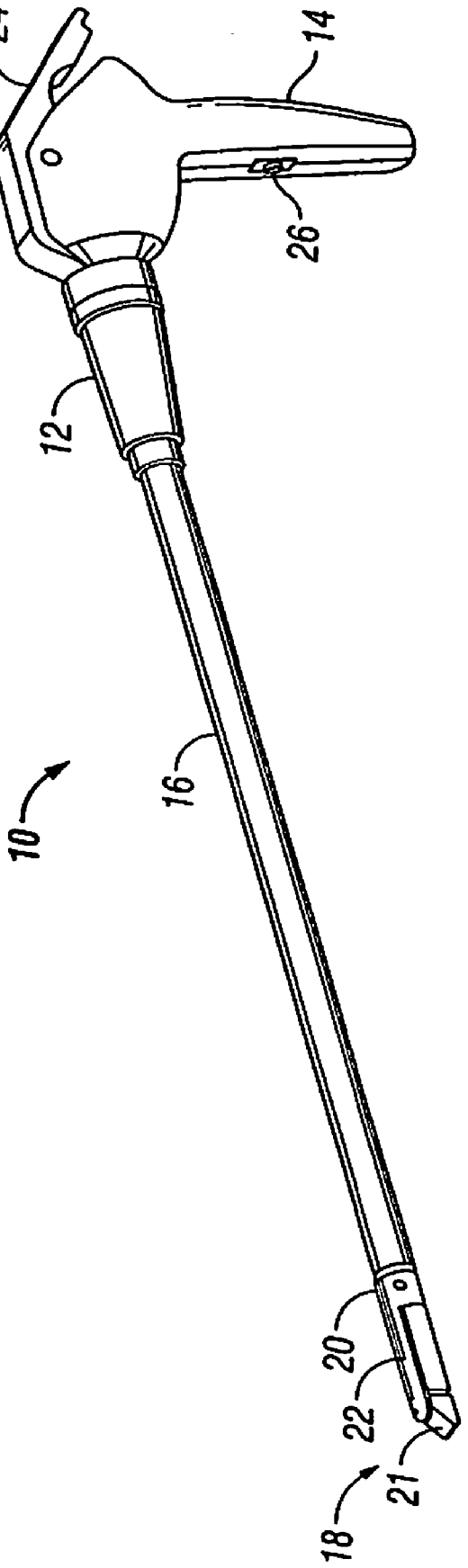
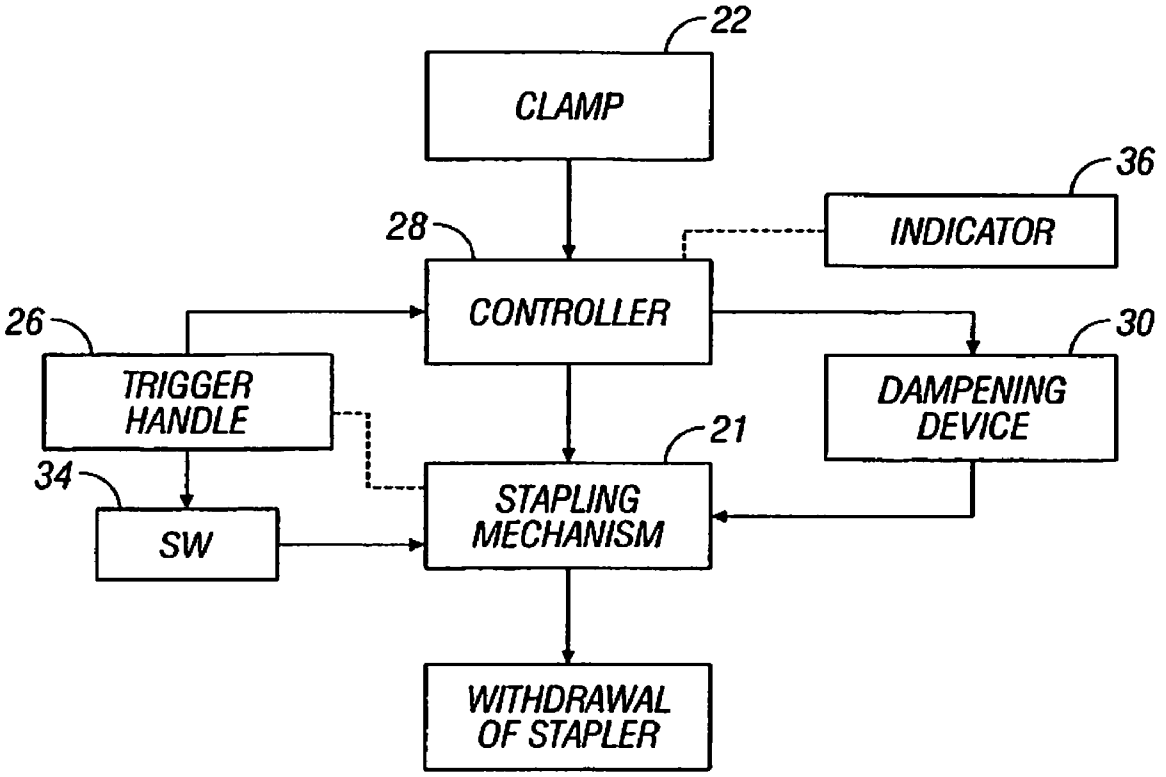


FIG. 1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CLAMP
36
INDICATOR
28
CONTROLLER
26
TRIGGER HANDLE
30
DAMPENING DEVICE
21
34
SW
STAPLING MECHANISM
WITHDRAWAL OF STAPLER

FIG. 2

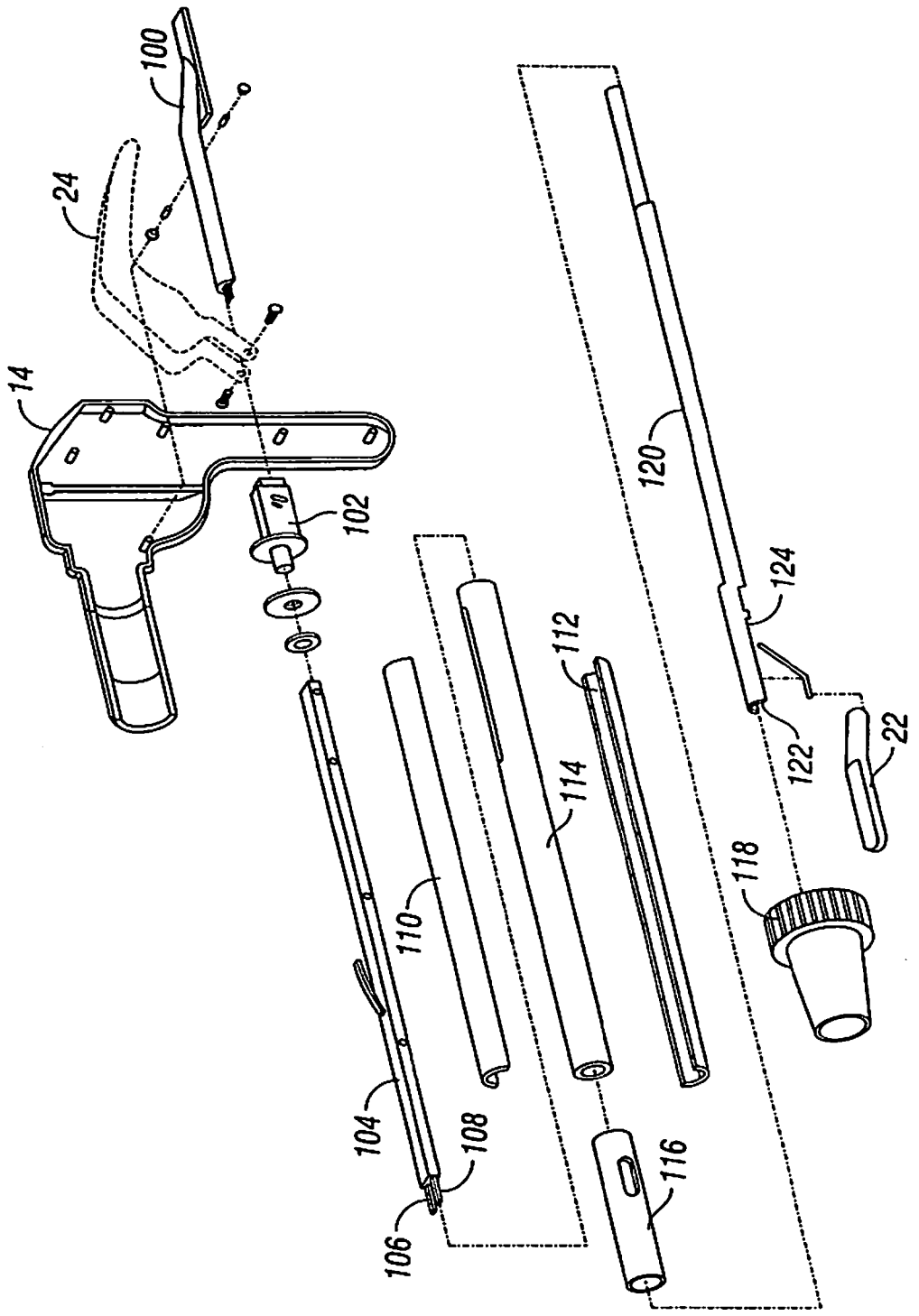
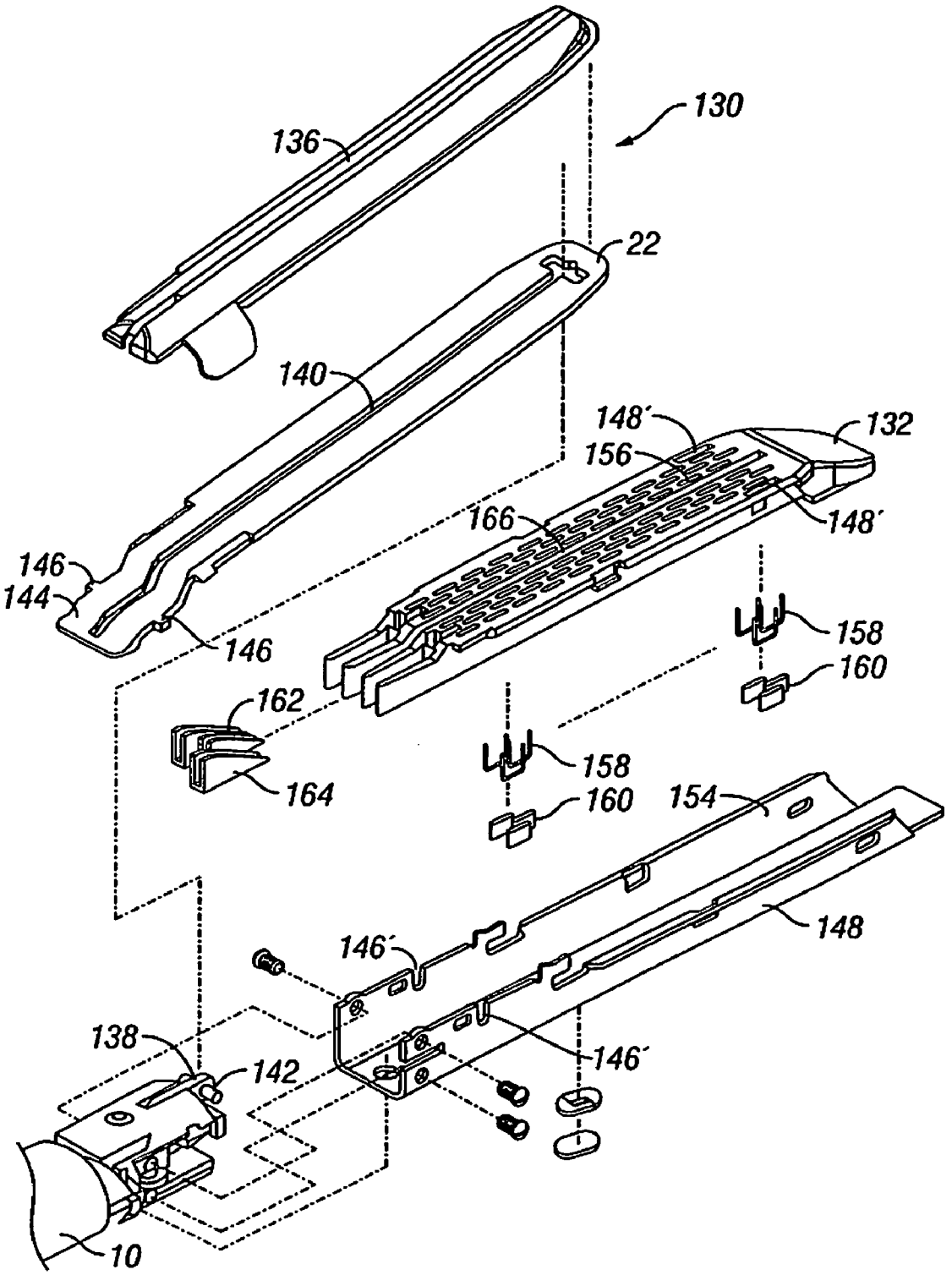


FIG. 2A


130
136
22
140
148'
132
156
166
148'
146
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146
158
160
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164
158
160
154
148
146'
146'
138
142
10

FIG. 2B

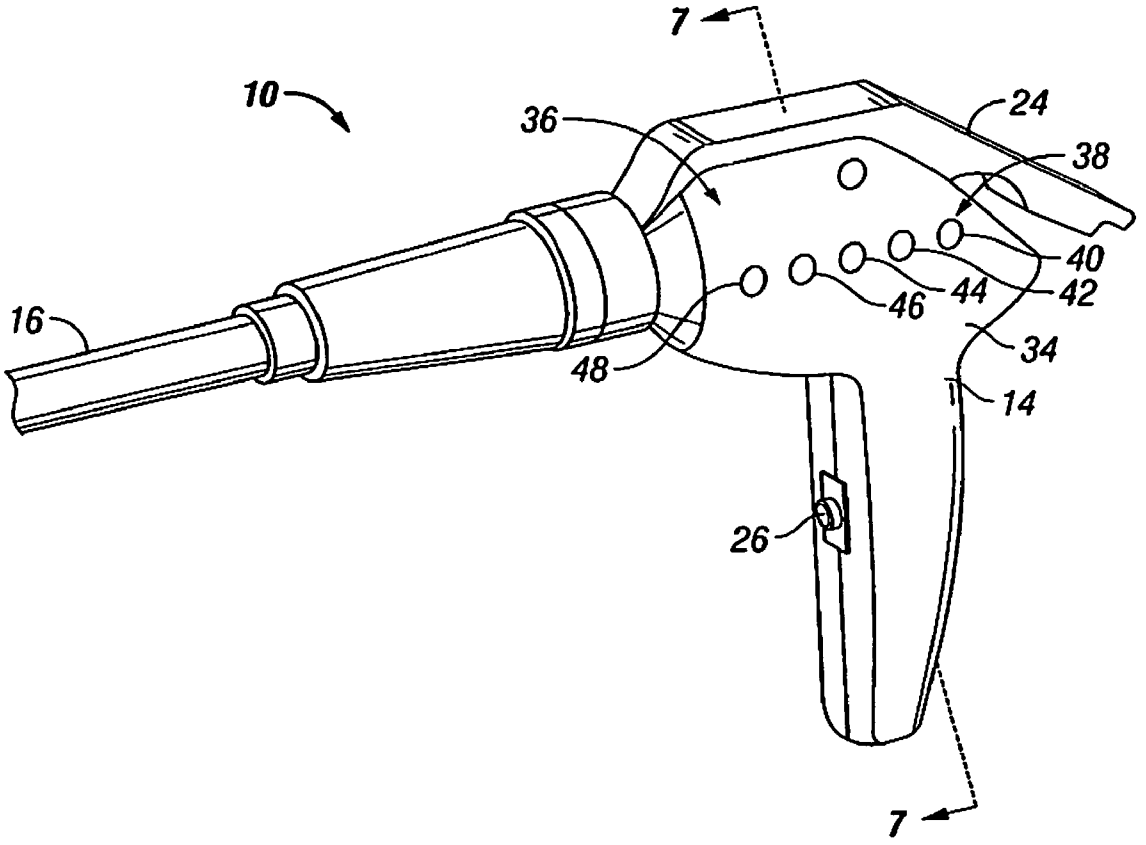

FIG. 3

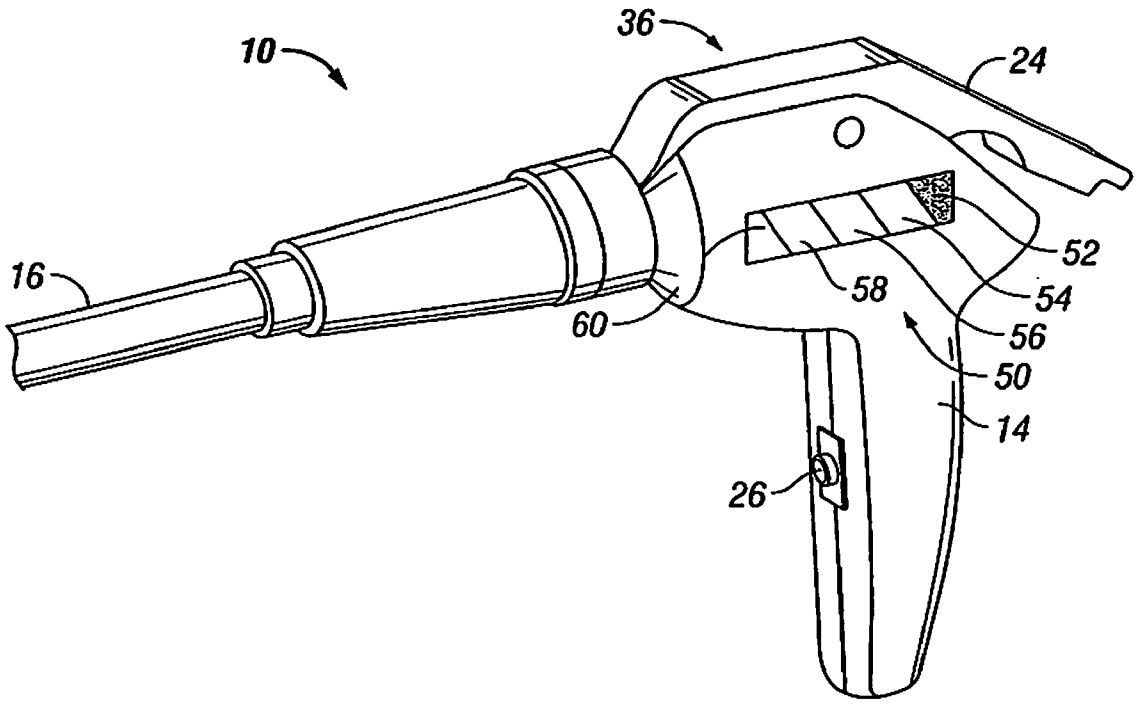

FIG. 4

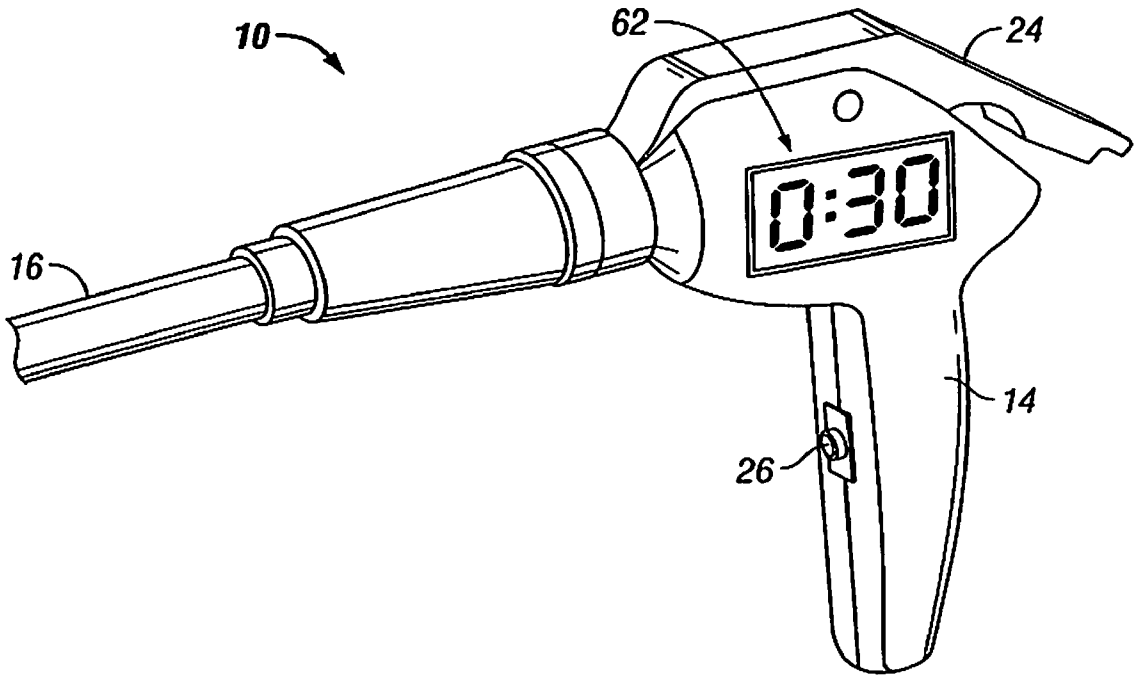

FIG. 5

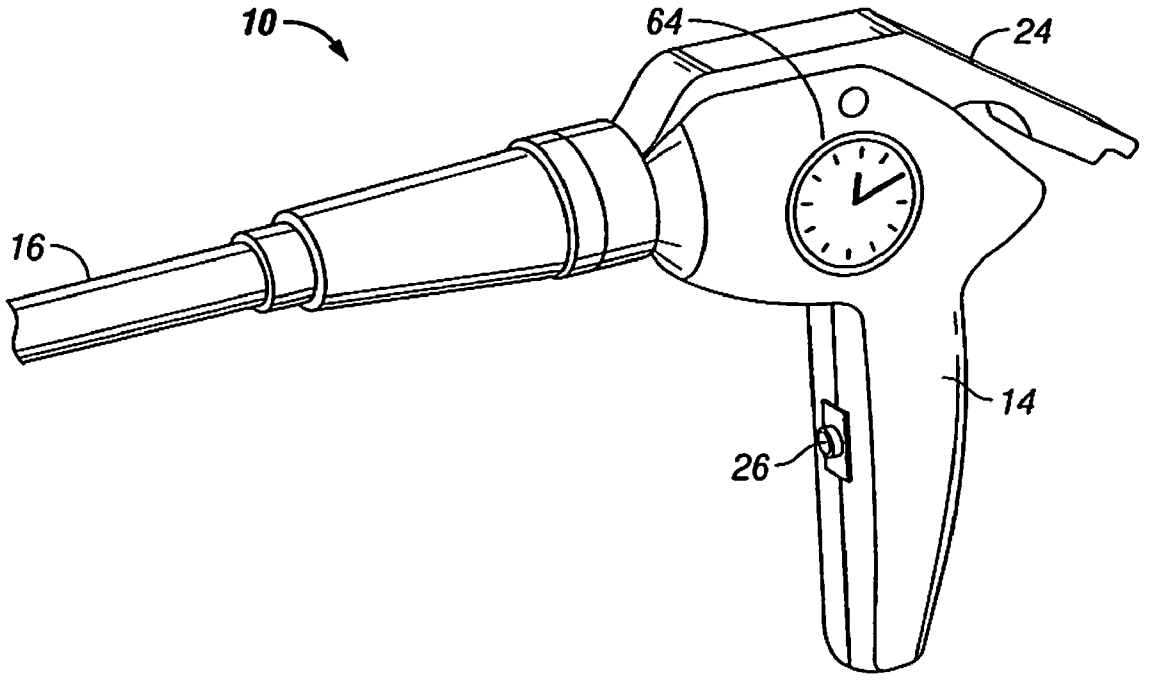

FIG. 6

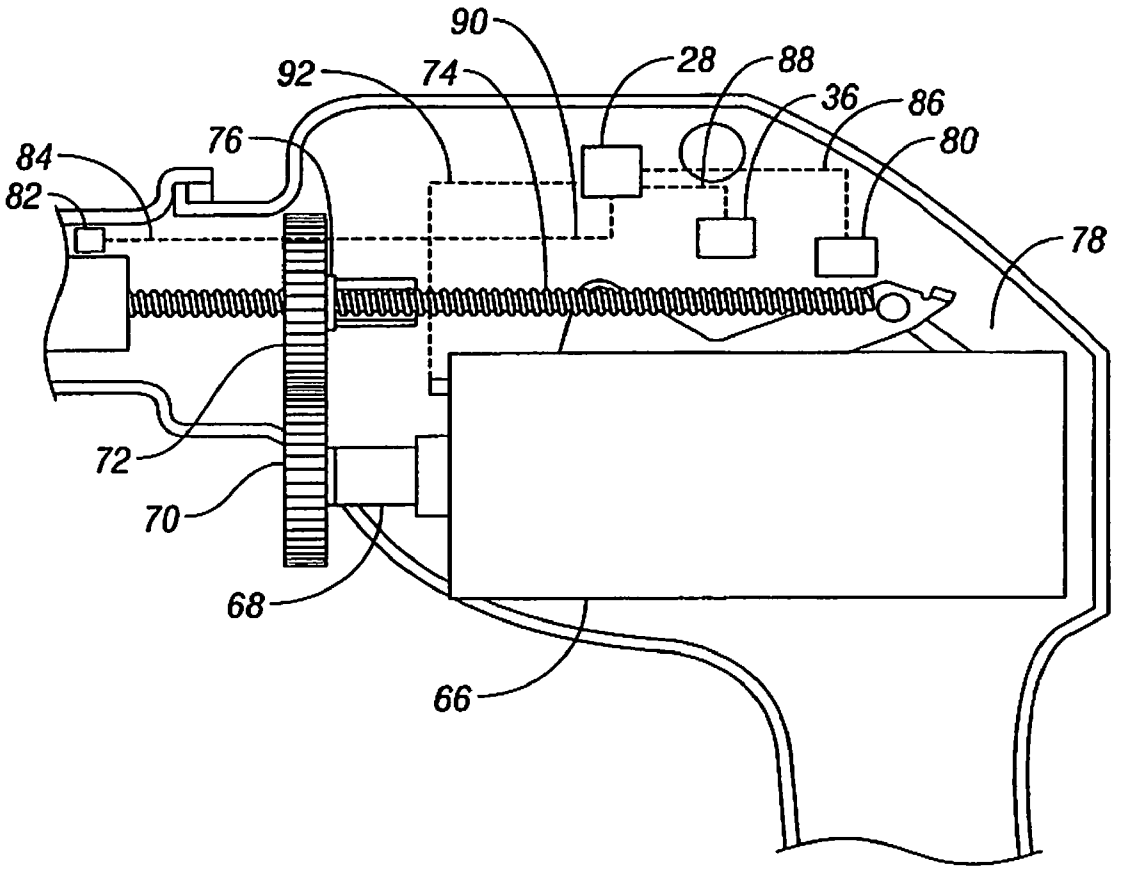

FIG. 7

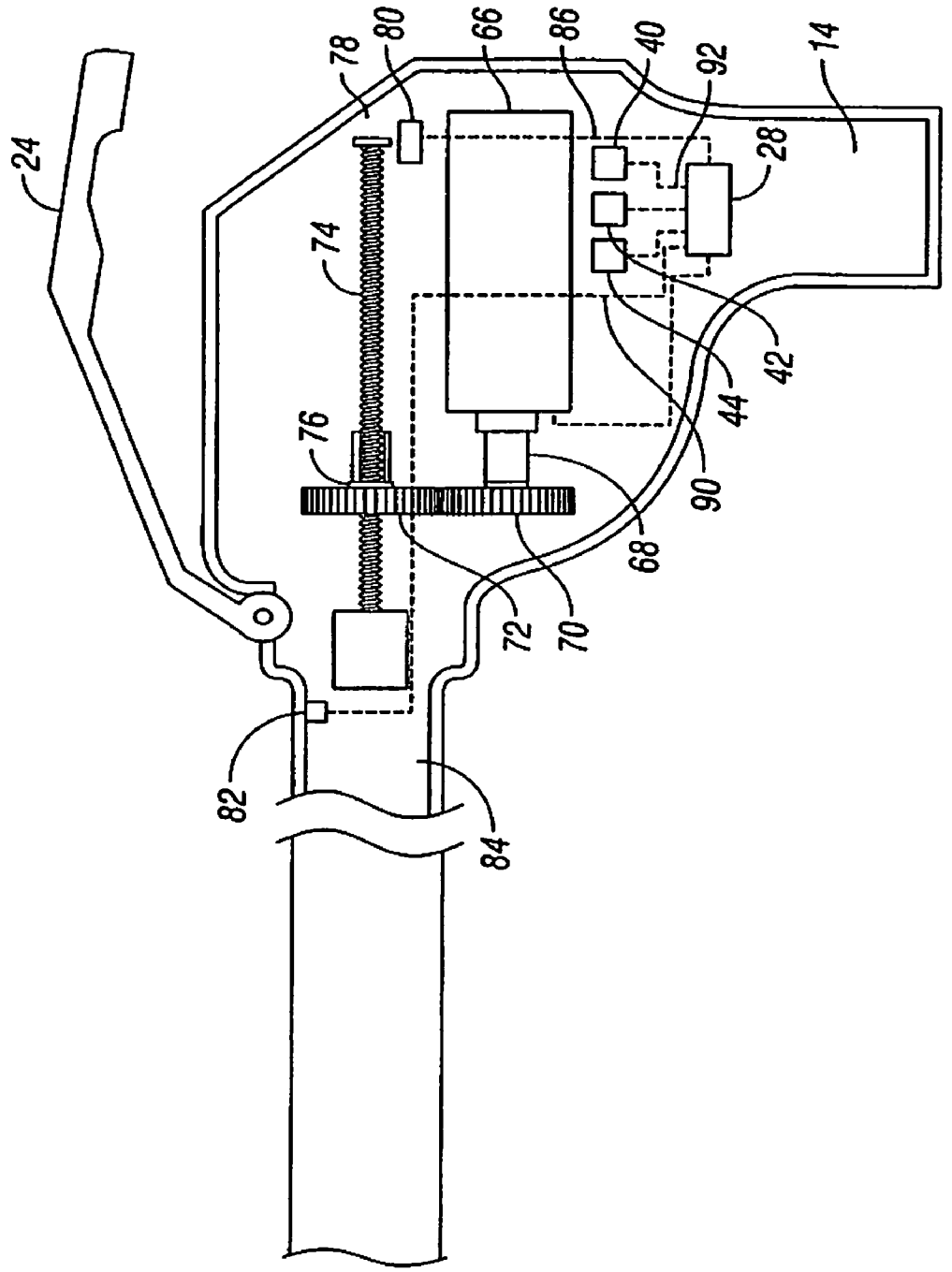

FIG. 8

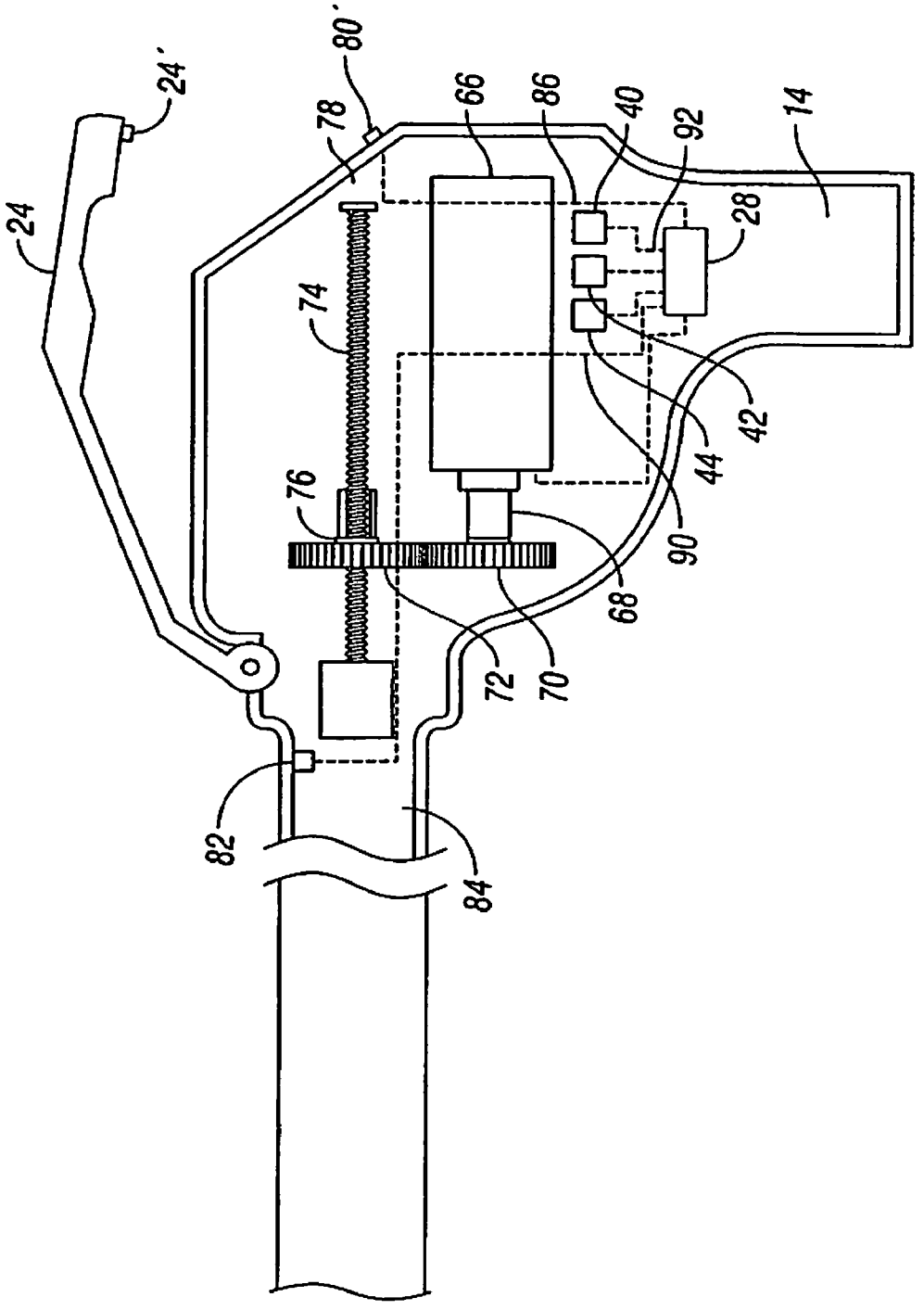

FIG. 8A

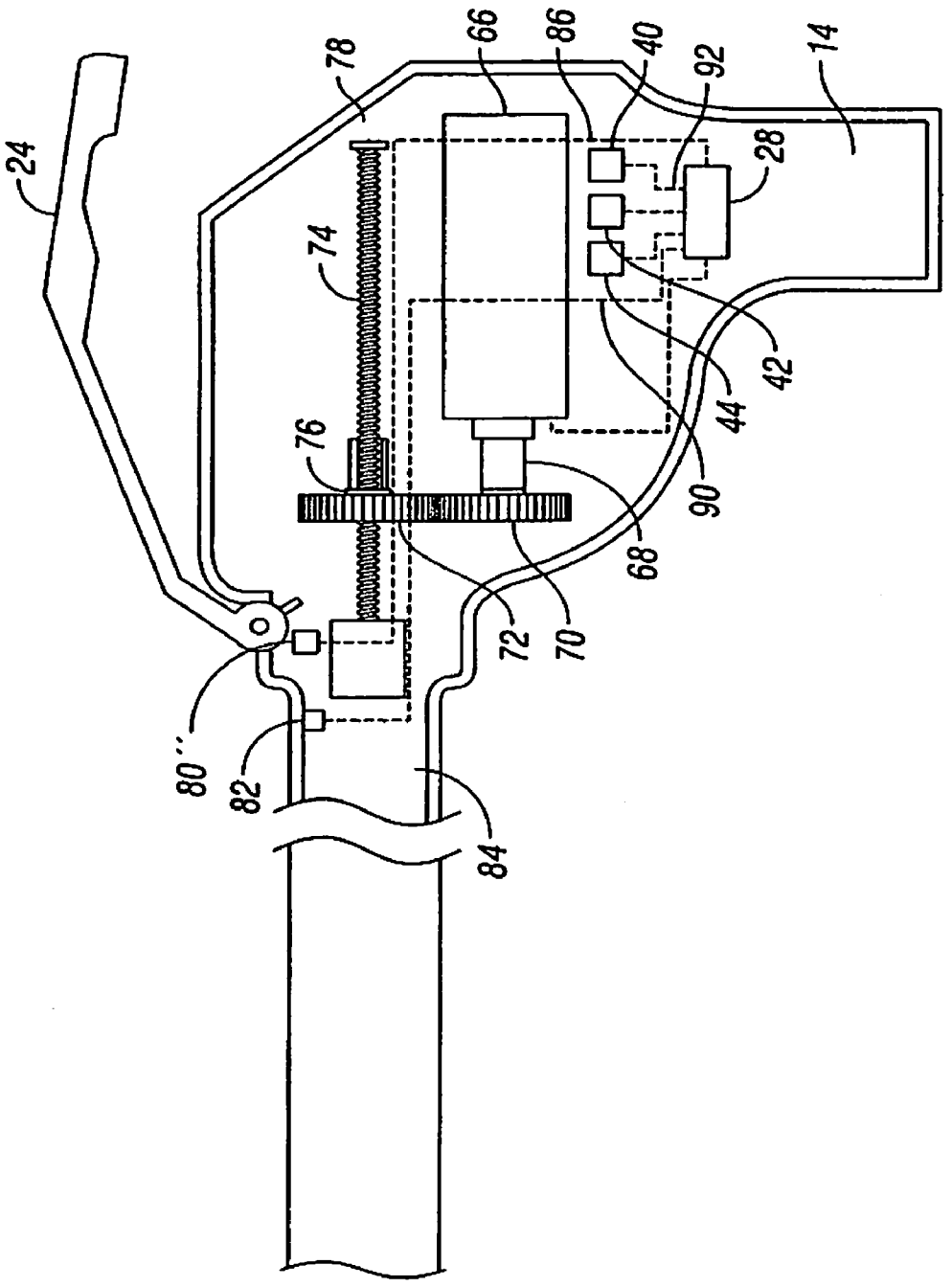

FIG. 8B

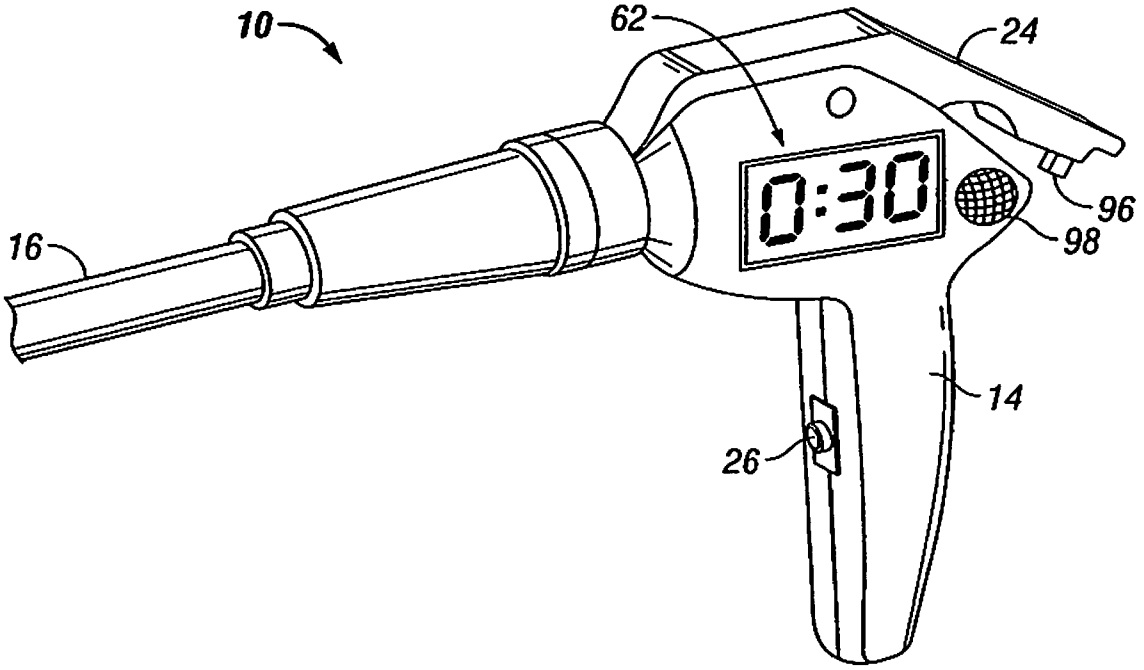

FIG. 9

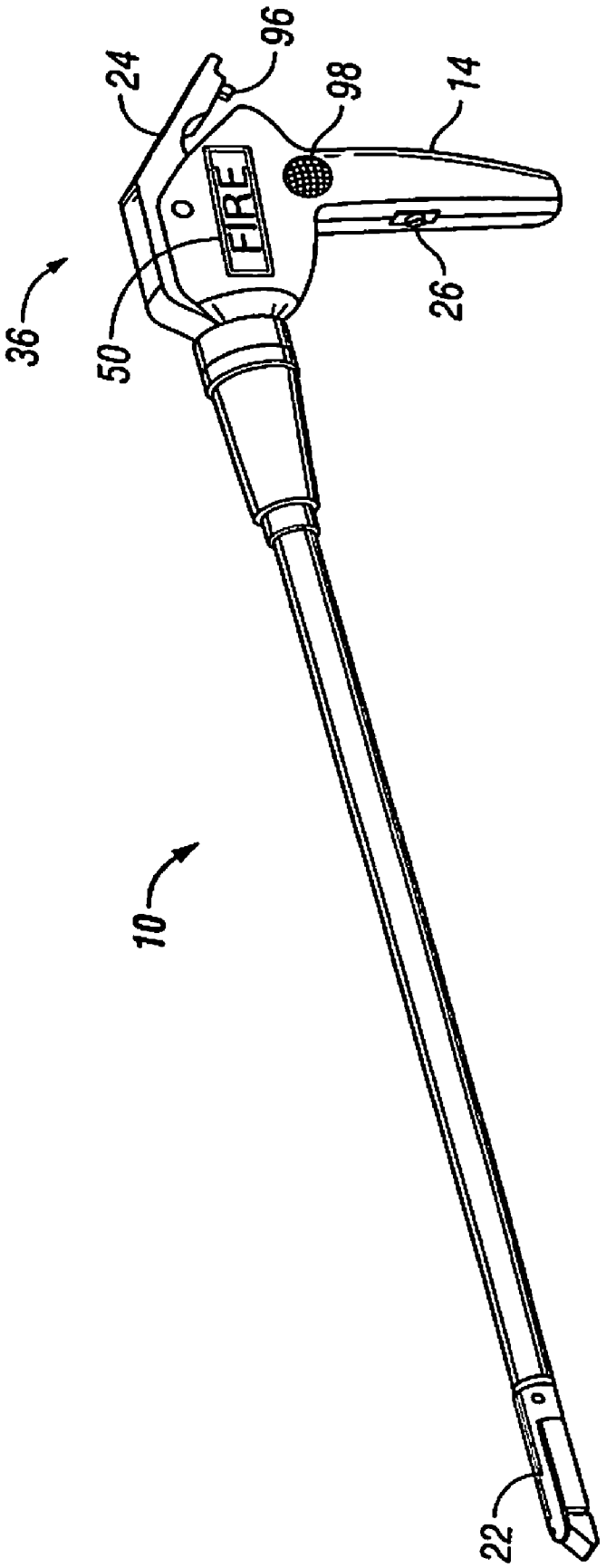

FIG. 10

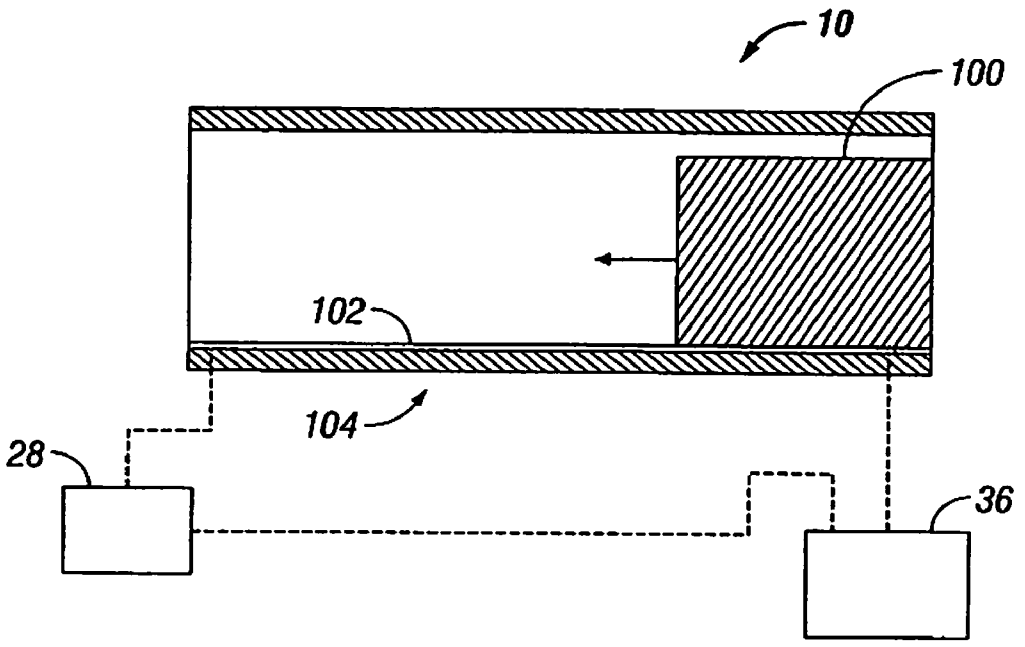

FIG. 11

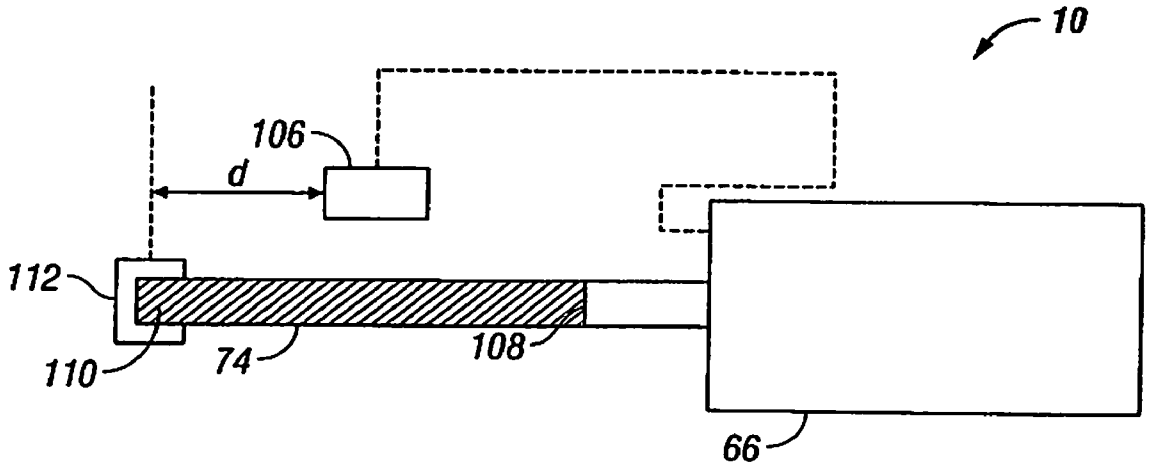

FIG. 12

SURGICAL STAPLER WITH TIMER AND FEEDBACK DISPLAY

CROSS REFERENCE TO RELATED PATENT APPLICATIONS

This patent application is a continuation of U.S. patent application Ser. No. 11/446,282 filed on Jun. 2, 2006, now U.S. Pat. No. 7,464,847, which claims priority to U.S. Provisional Patent Application Ser. No. 60/687,406 filed on Jun. 3, 2005 and U.S. Provisional Patent Application Ser. No. 60/687,244 filed on Jun. 3, 2005. The disclosures of each of these prior applications are incorporated by reference in their entirety.

BACKGROUND

1. Technical Field

The present disclosure relates to surgical instruments. More particularly, the present disclosure relates to a surgical stapling device that has a feedback and a timer device. Even more particularly, the present disclosure relates to a surgical stapling device that has a controller to modulate one or more parameters of the surgical stapling device and to provide for compression of tissue. Still even more particularly, the present disclosure relates to a surgical stapling device that may also include a sensory indicator (i.e., visual, audible, tactile) which determines position, time, or other valuable user feedback.

2. Background of the Related Art

Once under pressure from a jawed structure, such as a clamping device, of a surgical stapler, the body tissue will slowly compress. Compression by a clamping device reduces the amount of blood and fluid to the clamped tissue. Without such compression, an uncompressed body tissue remains thicker whereas the compressed body tissue would be thinner, and more compact. Compressing the tissue also causes blood and other fluid to generally traverse from the high pressure or compressed area to another low pressure or adjacent area.

Once released, the fluid due to the visco-elastic property of the tissue will return from the adjacent area to the previously compressed tissue. Some current surgical stapling devices initially compress tissue prior to the introduction of the staple into the body tissue. The amount of time tissue is compressed is currently left to the discretion of the surgeon. The surgeon manually controls the amount of time that the tissue is compressed prior to firing the staples into tissue. It would be therefore desirable to have a surgical stapling device that consistently fires staples after a predetermined amount of compression.

SUMMARY

According to a first embodiment of the present disclosure, there is provided a surgical stapler that has a handle assembly including a stationary handle and a pivotable handle mounted for manipulation through an actuating stroke. In another embodiment, the stapler may have a trigger that is operable to manipulate a cam member through the actuating stroke. The stapler also has an elongated body extending distally from the handle assembly and defining a longitudinal axis and a staple cartridge supported adjacent the distal end of the elongated body and containing a plurality of staples.

The stapler further has an anvil pivotally mounted in relation to the cartridge adjacent the distal end of the elongated body with the anvil having a fastener forming surface thereon and being mounted for pivotal movement in relation to the cartridge between an open position having a distal end spaced from the staple cartridge and a closed position in close cooperative alignment with the staple cartridge. The stapler also has an actuation sled supported within the cartridge. The actuation sled moves to urge the plurality of staples from the cartridge.

The stapler further has a drive assembly including a body having a working end and a cam member supported on the working end. The cam member is positioned to translate relative to the anvil to maintain the anvil in the closed position during firing of the stapler. The trigger or pivotable handle is operatively connected to the drive assembly such that manipulation of the pivotable handle through its actuating stroke effects translation of the cam member relative to the anvil. The stapler also has a channel for supporting the staple cartridge and a controller configured to control the actuation sled supported within the cartridge. The controller delays movement of the actuation sled to urge the plurality of staples from the cartridge for a predetermined time period when the anvil is in the closed position and in cooperative alignment with the staple cartridge.

According to another aspect of the present disclosure, the surgical stapler has a handle assembly including a stationary handle and a trigger configured to manipulate a cam member through an actuating stroke. The stapler also has an elongated body extending distally from the handle assembly and defining a longitudinal axis and a staple cartridge supported adjacent the distal end of the elongated body with staples. The stapler further has an anvil pivotally mounted in relation to the cartridge adjacent the distal end of the elongated body. The anvil has a fastener forming surface thereon and is mounted for pivotal movement in relation to the cartridge between an open position having a distal end spaced from the staple cartridge and a closed position in close cooperative alignment with the staple cartridge.

The stapler also has an actuation sled supported within the cartridge. The actuation sled moves to urge the staples from the cartridge. The drive assembly includes a body having a working end and a cam member supported on the working end. The cam member is positioned to translate relative to the anvil to maintain the anvil in the closed position during firing of the stapler.

The trigger is connected to the drive assembly such that manipulation of the trigger through its actuating stroke effects translation of the cam member relative to the anvil. The stapler also has a channel for supporting the staple cartridge. The stapler also has a controller. The controller is configured to control the actuation sled supported within the cartridge. The controller delays the actuation sled's movement to urge the plurality of staples from the cartridge for a predetermined time period when the anvil is in the closed position and in cooperative alignment with the staple cartridge. The surgical stapler also has an indicator connected to the controller. The controller controls the indicator to provide an indication when the predetermined time period is reached.

According to another embodiment of the present disclosure, there is provided a method for stapling tissue. The method includes the steps of locating tissue between a staple cartridge and an anvil and compressing tissue between the staple cartridge and the anvil. The method also has the step of manipulating an actuator to fire staples from the staples cartridge. The actuator is configured to automatically delay firing staples for a predetermined time period. The predetermined time period is suitable in length to allow compression of the tissue for the predetermined time period and to allow tissue to settle from a first initial state into a second compressed state. The method also has the steps of urging staples

from the staple cartridge through the tissue at the elapse of the predetermined time period when the tissue is in the second compressed state.

According to another aspect of the present disclosure, the surgical stapler has a controller to place a delay between actuation of the firing mechanism component and actual firing of the staple.

According to another aspect of the present disclosure, the surgical stapler has a control device that controls a stroke parameter, a distance parameter and/or a time parameter of a firing mechanism component to increase a tissue compression time of the clamp.

According to still another aspect of the present disclosure, the surgical stapler has a motor and a first switch. The first switch is connected to a motor and delays the motor from actuating in order to achieve an amount of tissue compression by a clamp. The surgical stapler may have a second switch. The second switch senses another location of a drive screw and actuates a reverse function of the motor to return the drive screw to an initial position.

According to still yet another aspect of the present disclosure, the surgical stapler has an indicator that measure a distance traveled of the drive screw or a tissue compression time of the clamp.

According to still another aspect of the present disclosure, the surgical stapler has a visual indicator that indicates a position of the firing mechanism component or indicates a status condition of the surgical stapling.

In another embodiment of the present disclosure, there is provided a surgical stapler. The stapler has a handle assembly including a trigger and a clamping device with a staple cartridge including a plurality of staples and an anvil having a fastener forming surface thereon. The stapler has a controller configured to determine an occurrence of clamping by the anvil and the staple cartridge. The controller controls a firing of the plurality of staples from the staple cartridge. When the trigger is actuated the controller delays firing of the plurality of staples from the staple cartridge to provide for a predetermined time period of tissue compression of the tissue between the anvil and staple cartridge. The controller outputs a control signal to allow firing once the predetermined time period is reached.

DESCRIPTION OF THE DRAWINGS

Other and further objects, advantages and features of the present disclosure will be understood by reference to the following specification in conjunction with the accompanying drawings, in which like reference characters denote like elements of structure and:

FIG. **1** is a perspective view of a first embodiment of a surgical stapler of the present disclosure;

FIG. **2** is a block diagram of a number of components of the surgical stapler of FIG. **1**;

FIG. **2**A is an exploded view of a channel of the surgical stapler of FIG. **1**;

FIG. **2**B is an exploded view of the staple cartridge, anvil and the drive sled of FIG. **1**;

FIG. **3** is a perspective view of another embodiment of the surgical stapler of the present disclosure having a plurality of lights;

FIG. **4** is a perspective view of still another embodiment of the surgical stapler with a linear indicator or display;

FIG. **5** is a perspective view of yet another embodiment of the surgical stapler having a digital indicator or display;

FIG. **6** is a perspective view of still another embodiment of the surgical stapler with an analog indicator or display;

FIG. **7** is a cross sectional view of the surgical stapler of FIG. **3** along line **7-7**;

FIG. **8** is another cross sectional view of still another embodiment of the surgical stapler of the present disclosure along line **7-7** of FIG. **3** with the stapler having a first switch and a second switch;

FIG. **8**A is another cross sectional view of another embodiment of the stapler of FIG. **8** having the first switch which engages a tab on the lever;

FIG. **8**B is still another cross sectional view of yet another embodiment of the stapler of FIG. **8** having the first switch located distally on the lever;

FIG. **9** is another perspective view of still another embodiment of the surgical stapler with an audible alarm;

FIG. **10** is still another perspective view of another embodiment of the surgical stapler having the display showing an image;

FIG. **11** is a schematic/cross sectional view of a travel path of a drive member through an endoscopic portion of the surgical stapler with a resistor strip; and

FIG. **12** is a schematic of another embodiment of the surgical stapler having a non-contact sensor.

DETAILED DESCRIPTION

In the drawings and in the description which follows, the term "proximal", as is traditional, will refer to the end of the apparatus which is closest to the operator, while the term "distal" will refer to the end of the apparatus which is furthest from the operator.

The present disclosure can be used with any stapler device known in the art and is intended to encompass the same, and is intended to be discussed in terms of both conventional and endoscopic procedures and apparatus. However, use herein of terms such as "endoscopic", "endoscopically", and "endoscopic portion", among others, should not be construed to limit the present disclosure to an apparatus for use only in conjunction with an endoscopic tube. The apparatus of present disclosure may find use in procedures in these and other uses including but not limited to uses where access is limited to a small incision such as arthroscopic and/or laparoscopic procedures, or other conventional medical procedures. The present mechanism may also be used with surgical stapling devices that have independent or combined clamping and firing procedures. The present disclosure may further be incorporated with surgical stapling devices that have simultaneous or dependent clamping and firing mechanisms. The present disclosure is also intended to be used with such surgical stapling devices which have a discrete clamping gradient.

Referring now to the figures, wherein like reference numerals identify similar structural elements of the subject disclosure, there is illustrated in FIG. **1** a self-contained, powered surgical stapler constructed in accordance with an embodiment of the subject disclosure and designated generally by reference numeral **10**. The surgical stapler **10** is generally intended to be disposable, however the disposable arrangement is non-limiting and other non-disposable arrangements may be contemplated and are within the scope of the present disclosure.

The surgical stapler **10** of the present disclosure (shown in a perspective view in FIG. **1** and described herein) includes a frame generally represented by reference numeral **12** and handle generally represented by reference numeral **14**. The frame **12** defines a series of internal chambers or spaces for supporting various inter-cooperating mechanical compo-

nents of the surgical stapler **10** as well as a number of staples therein for the application to the body tissue.

The frame **12** supports a portion **16** or an extended tube-like portion. The portion **16** is capable of being rotated and has a relatively narrow diameter in a range of about 10 millimeters, and is for insertion into a small opening or tube inserted into the body, such as in the abdominal cavity, or other similar body cavities. The portion **16** has a longitudinal axis and has a length appropriate for reaching the operation site in the interior of the body. The surgical stapler **10** may be used in conjunction with other instruments such as endoscopes or other such optical devices for visually examining the interior of the body, for example, cameras by means of CCD devices, fiber optics or other optical or recording devices.

Generally, portion **16** of the surgical stapler **10** is inserted through the small opening or wound, and is manipulated to the operation site. The present disclosure is intended to be used with any surgical stapler including but not limited to surgical staplers having simultaneous clamping and independent clamping.

Portion **16** has a fastening assembly generally represented by reference number **18** and cutting assembly (not shown) that is known in the art. The fastening assembly **18** and the cutting assembly (not shown) are located in a housing **20** which carries a fastener and an optional cutter to the operation site. The fastening assembly **18** in this particular embodiment has a jaw or a staple cartridge **21** and a second jaw or anvil **22**. The staple cartridge **21** and the anvil **22** may be brought into close cooperative alignment with one another so the jaws **21**, **22** form a clamp therebetween. The jaws **21**, **22** may be a first and second jaw that open and close or may be another clamping type structure as is known in the art. The jaws **21**, **22** are defined by a staple cartridge **21** located therein. The staple cartridge **21** may be located at the distal end of the housing **20**, in the jaws **21**, **22** themselves or may be located in other locations as described in U.S. Pat. No. 7,044,353 to Mastri, et al. which is herein incorporated by reference in its entirety. The staple cartridge **21** has one or a number of rows of staples. The surgical stapler **10** also has an anvil (not shown) and further may include an optional knife (not shown) as is well known in the art for accomplishing the stapling. It is appreciated that the closing of the jaws **21**, **22** with the staple cartridge **21** and the anvil **22** may be accomplished by pivoting the anvil **22** relative to the staple cartridge **21**, or by pivoting the staple cartridge **21** relative to the anvil **22**, or by pivoting both the staple cartridge **21** and the anvil **22**.

Generally, actuating the operating portion of the fastening assembly **18** is accomplished via intermediate components disposed on or within the narrow longitudinally extending tubular portion **16**. In one non-limiting embodiment, a cylindrical tubular sleeve member surrounds the portion **16**. The sleeve may be manipulated in a direction with the longitudinal axis of the surgical stapling device. The sleeve slides onto the anvil **22** for closing the jaws **21**, **22** that are biased open by a biasing device (not shown) to accomplish the clamping. The surgical stapler **10** of the present disclosure has three basic actions or functions, however, the present disclosure is intended to be used with any surgical stapler including but not limited to surgical staplers having simultaneous clamping (i.e., clamping and firing the stapler at the same time) and independent clamping (i.e., clamping prior to the staple firing).

First, portion **16** is introduced into the human or animal body and is positioned with the jaws **21**, **22** aligned at the desired stapling site to receive the target tissue. This may involve rotation of the portion **16** relative to the body, either by rotating the surgical stapler **10** as a whole, by rotating simply the portion **16** relative to the frame **12** as permitted, or a combination of both actions. Thereafter (i.e., secondly), the surgical stapler **10** secures the target body tissue between the staple cartridge or jaw **21** in the distal portion of the housing **20** and the anvil **22**. This is accomplished by a clamping action of the jaws **21**, **22** or alternatively by another similar or different clamping member.

The jaws **21**, **22** are allowed to remain in the closed position for a desired period of time depending on the particular tissue. By configuring the jaws **21**, **22** to remain closed for a predetermined period of time allows any excess liquid or fluid in the tissues to drain out of the body tissues prior to actuation of the stapling cartridge **21**. This ensures that the liquid does not traverse out of the tissues after firing to form non-uniform staples and instead ensures a proper and uniform staple formation.

With the target tissue clamped between the anvil **22** and the staple cartridge **21**, a camming surface which surrounds the housing **20** and anvil **22** is employed to close the jaws **21**, **22** of the surgical stapler **10** and clamp the tissue between the anvil **22** and the tissue contacting surface of the staple cartridge **21**. The jaws **21**, **22** are clamped by actuation of a lever **24** opposite the jaws **21**, **22** as is known in the art. Thereafter, the surgeon applies the staples to the body tissue. A longitudinally extending channel is employed to deliver longitudinal motion to an axial drive member and a tissue cutting knife as is known in the art.

The axial drive member or an axial drive screw contacts pusher elements. The pusher elements drive the staples through the body tissue against the fastener or forming surface of the anvil as discussed herein. Typically, in the art the surgical stapler **10** fires usually by an actuation of a first trigger handle or alternatively using a trigger switch **26**. Thereafter, the clamping action of the jaws **21**, **22** is released and the surgical stapler **10** or a portion thereof may be withdrawn from the body.

Referring now to FIG. **2**, there is shown a block diagram of the surgical stapler **10** of the present disclosure. According to a first aspect of the present disclosure, the surgical stapler **10** may have an optional controller **28**. The controller **28** is any electronic device being coupled to a memory for executing one or more readable program instructions or alternatively may be a suitable analog circuit. Still further, the controller **28** may be a suitable mechanical member or linkage for controlling one or more functions of the surgical stapler **10**.

The controller **28** is connected to an internal or external power supply and a motor and is connected between the anvil **22** and the stapling cartridge **21**. In an alternative embodiment, a trigger handle or another actuating switch or component **26** is mechanically or electronically linked or otherwise connected to the stapling cartridge **21** as is known in the art as indicated by a dotted line, and the present disclosure is not intended to be limited to any configuration. Once the stapling cartridge **21** is fired using the trigger switch **26**, the jaws **21**, **22** are opened and the firing mechanism is retracted. The surgical stapler **10** as a whole may be withdrawn from the body tissue or may be manipulated for a next or second stapling operation as shown.

The present surgical stapler **10** has the controller **28** which is connected to one of the jaw or anvil **21** or jaw or staple cartridge **21** and the trigger switch **26** or is connected to both jaws **21**, **22** and the trigger switch **26**. In one embodiment, once the desired site is reached, the surgeon uses the jaws **21**, **22** to compress the selected body tissue. Alternatively, the surgical stapler **10** may have a single drive component that can actuate both the anvil **22** and stapling cartridge **21**.

Thereafter, the controller **28** may provide for a requisite amount of delay between clamping and firing (or after clamping and before firing) to ensure tissue compression and expulsion of fluid. After the desired compression is reached, the stapling cartridge **21** may be automatically engaged by the controller **28** to fire the staples from the stapling cartridge **21** into the body tissue or alternatively the controller **28** may send a signal to the surgeon thereby informing the surgeon a suggestion that the surgeon is to fire the staples. It is envisioned that the firing may be automatic or manual.

Furthermore, the controller **28** may control the speed with which the staples are fired from the staple cartridge **21**. Still further, the controller **28** may control an amount of delay before firing. The controller **28** in one embodiment may provide for a predetermined amount of time to elapse prior to outputting a signal to the stapling cartridge **21**. In another powered stapler embodiment, the controller **28** may slow a motor speed to increase the body tissue compression time.

In still another embodiment, the controller **28** may engage a dampening device **30**. The dampening device **30** is configured to slow the actuating of the staple cartridge **21** in order to increase the overall compression time of the body tissue. Such a dampening device **30** may be a hydraulic or a pneumatic type damper or any other device that may dampen or modulate the operation of one or more components of the surgical stapler **10**. In another embodiment, the trigger **26** may simply hold the fire signal for a predetermined time period in associated control circuitry and upon the expiration of the predetermined time period may communicate the signal to the stapling cartridge **21**.

The controller **28** may be configured to slow a motor speed, modulate a gear or, still further, engage a circuitry of the motor to slow an operation thereof to otherwise reduce actuation, i.e., a rotation rate of the axial drive screw. Still further, the surgical stapler **10** may also include an override switch **32**. The override switch **32** is an automatic or manual device (or other switch) that selectively disengages the controller **28** to permit direct actuation of the stapling cartridge **21** by the trigger switch **26** without any delay at the surgeon's discretion.

In one aspect of the present disclosure, the present surgical stapler **10** includes jaws **21**, **22** which compresses tissue between the anvil **130** and the stapler cartridge **132** of the stapling cartridge **21** (FIG. **2**B). The jaws **21**, **22** are understood in the art as a device that allows the surgeon to manipulate and compress tissue between the anvil **130** and the staple cartridge **132** prior to urging of the staples **158** from the staple cartridge **132** as shown in FIG. **2**B. The jaws **21**, **22** may be independently powered by a power source such as a motor or pneumatic device, or may be powered by the same power source as the staple cartridge **21**. The surgical stapler **10** uses the jaws **21**, **22** to clamp tissue between the stapler cartridge **132** and the anvil **130** (FIG. **2***b*), then when the stapler **10** is fired the jaws **21**, **22** may be tightened further and then the staples **158** urged from the stapling cartridge **21**.

In one aspect, the surgical stapler **10** may pre-clamp or compress tissue using the jaws **21**, **22** for a first interval. The first time interval may be preset and fixed, or variable depending on the tissue type. The first time interval may be for minutes, seconds or any other variable or fixed predetermined period of time. Then prior to stapling, the jaws **21**, **22** may further tighten to further compress the tissue for another second compression time interval and then fire. The second time interval may be different from the first time interval and can be shorter or longer than the first. In another aspect, the instrument may pre-clamp or compress tissue using the jaws **21**, **22** and then simply automatically fire the device to urge the staples **158** from the staple cartridge **132** at the conclusion of the first interval. Various configurations are possible, and the present surgical stapler **10** may have program instructions for any number of compression intervals desired by the surgeon and/or designer. The surgical stapler **10** may alternatively further use a second separate clamping device in association with the stapler **10**. It is understood that the present disclosure may be incorporated into an instrument that approximates the tissue before firing such as with a TA surgical stapler, or can be used with an instrument that requires no such approximation before firing such as U.S. Pat. No. 6,817,508 to Racenet, et al. which is herein incorporated by reference in its entirety.

In another embodiment of the present disclosure, the surgical stapling device **10** may provide the surgeon with feedback by virtue of an indicator **36**. The indicator **36** may display an amount of compression time and/or provide feedback of the status of the stapling, or display information relating to the location of the drive screw, or drive member. In another embodiment of the present disclosure, the surgical stapler **10** may not have separate clamping and firing actuators and include a clamping gradient indicator **36** or simultaneous clamping and firing indication mechanism. For example, the surgical stapler **10** may be configured to allow control of the firing speed which, in turn, controls the clamping speed and timing and then provide optimal compression for squeezing the tissue and pushing the blood and fluid out of the tissue at the desired site.

FIG. **2**A shows an exploded view of a number of components of the surgical stapler **10** of FIG. **1**. The stapler **10** has a rack **100** that is slidable in the handle portion **14**. The rack **100** interfaces with a clamp tube **102**. On a distal side of the clamp tube **102** is a channel **104**. The channel **104** engages with the clamp tube **102** and a pair of forks **106**, **108** on a distal side thereof. The stapler **10** also has an upper cover **110** and a lower cover **112**, and an extension tube **114**. The extension tube **114** engages with a collar tube **116**. The stapler **10** also has a rotation knob **118** with a channel portion **120**. The channel portion **120** has a pair of camming surfaces **122** on a distal end. The distal end also has a crimp **124** in a distal side to receive the anvil **22**.

In operation, the rack **100** slides and moves the clamp tube **102** distally. The clamp tube **102** is provided to interconnect the handle portion **14** and the extension tube **114**. The channel **104** is slidably mounted for reciprocal longitudinal motion. The extension tube **114** provides support for the surgical stapler **10** and has slots that interface with the collar tube **116**. The surgical stapler **10** also has a support **120** for longitudinal motion and to operate the stapling mechanism as described in FIG. **2***b*. The operation of these components is well known and is disclosed in U.S. Pat. No. 5,318,221 to Green, et at, which is herein incorporated by reference in its entirety.

Advantageously, the rack **100** moves distally to advance the channel **104** in a distal manner. The channel **104** delivers longitudinal motion to a pusher cam bar as is known in the art for operation of the stapler cartridge **21** shown in FIG. **2***b*. It should be appreciated that the components shown in FIG. **2***a* only illustrate one embodiment of the present surgical stapler **10**, and instead of the rack **100**, the surgical stapler **10** may have a drive screw (not shown) for longitudinal motion and in order to actuate the stapler cartridge **21**. Referring now to FIG. **2***b*, there is shown an exploded view of the anvil **22** and the stapler cartridge **132** having an actuation sled **169**.

Referring to FIG. **2***b*, the stapler cartridge **21** includes an anvil assembly **130** and a cartridge assembly **132** shown in an exploded view for illustration purposes. The anvil assembly **130** includes anvil portion **22** having a plurality of is staple

deforming concavities (not shown) and a cover plate **136** secured to a top surface of anvil portion **134** to define a cavity (not shown). The cover plate **136** prevents pinching of tissue during clamping and firing of the surgical stapler **10**.

The cavity is dimensioned to receive a distal end of an axial drive assembly **138**. The anvil **130** has a longitudinal slot **140** that extends through anvil portion **130** to facilitate passage of retention flange **142** of the axial drive assembly **138** into the anvil slot **140**. A camming surface **144** formed on anvil **22** is positioned to engage axial drive assembly **138** to facilitate clamping of tissue. A pair of pivot members **146** formed on anvil portion **130** is positioned within slots **146'** formed in carrier **148** to guide the anvil portion **130** between the open and clamped positions.

The stapler **10** has a pair of stabilizing members **152** engage a respective shoulder formed on carrier **148** to prevent anvil portion **30** from sliding axially relative to staple cartridge **132** as camming surface of the anvil **130** is deformed. Cartridge assembly **132** includes the carrier **148** which defines an elongated support channel **154**. Elongated support channel **154** is dimensioned and configured to receive the staple cartridge **132** which is shown above the carrier **148** in the exploded view of FIG. **2***b*. Corresponding tabs and slots formed along staple cartridge **132** and elongated support channel **148'** function to retain staple cartridge **132** within support channel **154** of carrier **148**. A pair of support struts formed on the staple cartridge **132** are positioned to rest on side walls of carrier **148** to further stabilize staple cartridge **132** within support channel **154**, however other arrangements to support the cartridge **132** on the channel **154** can be used and this arrangement is not limiting.

Staple cartridge **132** includes retention slots **156** for receiving a plurality of fasteners **158** and pushers **160**. Longitudinal slots **156** extend through staple cartridge **132** to accommodate upstanding cam wedges **162** of the actuation sled **164**. A central longitudinal slot **166** extends along the length of staple cartridge **132** to facilitate passage of a knife blade (not shown). During operation of surgical stapler **10**, actuation sled **164** is drive distally to translate through longitudinal slot **156** of staple cartridge **132** and to advance cam wedges **162** distally and into sequential contact with pushers **160**, to cause pushers **160** to translate vertically within slots **156** and urge fasteners **158** from slots **156** into the staple deforming cavities of anvil assembly **130** to effect the stapling of tissue.

Referring to FIG. **3**, the surgical stapler **10** may include indicator **36** which may be any device known in the art to provide sensory feedback to the surgeon. The indicator **36** may be any device that permits a visual, tactile or audible monitoring of one or more conditions of the surgical stapler **10**. The indicator **36** may be disposed on outer surface **34** and disposed on the handle **14**. Alternatively, the indicator **36** may be disposed on portion **16**, on the trigger switch **26**, on the lever **24** or in any other suitable location where the indicator **36** may be easily viewed by the surgeon without a change in position of change in footing by the surgeon.

In one embodiment, as shown the indicator **36** includes a number of light bulbs **38**. The lights **38** may be one light or a series of many lights bulbs or LEDs with one color or an assortment of two or more colors. Each of the lights **38** may have a color representing one or more conditions of the surgical stapler **10**. Alternatively, one or all of the lights **36** may flash to indicate a condition of the surgical stapler **10**.

Upon being actuated by the trigger switch **26**, the surgical stapler **10** may impart a delay before firing of the staples. However, in order to provide the proper feedback to the surgeon, the lights **38** provide, for example, a visual indication of the progress of the firing of the stapling cartridge **21**. For example, still referring to FIG. **3**, there is shown a first light **40**, a second light **42**, a third light **44**, a fourth light **46**, and a fifth light **48**. As the axial drive screw (not shown and in the handle) travels the predetermined drive path the lights **40**, **42**, **44**, **46**, and **48** illuminate in series to portray the relative distance of the drive screw on the exterior of the handle. When the lights **40**, **42**, **44**, **46**, and **48** are illuminated, the stapling cartridge **21** fires which ensures that proper tissue compression occurs prior to deployment of the staples.

Referring now to FIG. **4**, in another exemplary embodiment of the present disclosure, the surgical stapler **10** includes a linear indicator **50** having a plurality of discrete segments, first segment **52**, second segment **54**, third segment **56**, fourth segment **58**, and fifth segment **60**. Again, once the trigger switch **26** is actuated to fire the stapling cartridge **21**, the segments **52**, **54**, **56**, **58**, and **60** each illuminate in a predetermined pattern to indicate to the surgeon the status of the progression of the drive screw in the handle **14**.

Upon all of the segments **52**, **54**, **56**, **58**, and **60** being illuminated, the stapling cartridge **21** fires the staple into the body tissue with assurance that an amount of compression time of the body tissue has lapsed. Linear display **50** may have one or more different colors or combinations of colors to indicate a position of the drive screw such as "red" to indicate firing and "green" to indicate that the firing is complete or vice versa. Still further the linear display **50** may display one or more graphical representations, images, or pictures to indicate one or more conditions or operating parameters of the surgical stapler **10**.

For example, the linear display **50** may indicate "FIRE" or "COMPLETE", or any other graphical representation to indicate that surgical stapler **10** will fire at the predetermined time period. Various possible combinations are possible and all are within the scope of the present disclosure.

In still another exemplary embodiment of the present disclosure shown in FIG. **5**, the surgical stapler **10** may include a digital display **62**. The digital display **62** may indicate a count down or count up (or other time interval) after actuation of the trigger switch **26**. For example, the digital display **62** may count down to the desired stapling time after compression to ensure a predetermined amount of tissue compression by the jaws **21**, **22**. The digital display **62** may be activated by the jaws **21**, **22** being brought in close alignment with one another or activated independent of clamping. A desired clamping interval may be preset for desired tissue.

Alternatively, the digital display **62** may be selectively preset and input by the surgeon using an input device (not shown). The surgeon may input a time period of clamping. Thereafter, the display **62** will suggest firing at the elapse of the time period, or may automatically to fire after a predetermined clamping time elapses (e.g., such as from about ten seconds to forty five seconds) to ensure proper tissue compression. The digital display **62** may be configured to count down from the predetermined set interval and visually communicate a signal to the controller **28**. The controller **28** after receiving the signal allows the desired time period to elapse. After the set time period expires, the controller **28** may communicate a second signal to actuate the stapling cartridge **21**. Alternatively, the controller **28** may simply modulate the speed of the motor to commence operation at a speed suitable to actuate the stapling cartridge **21** at the end of the desired time period. In still yet another embodiment, the digital display **62** may be configured to initiate counting after commencement of the clamping of tissue and then simply display the time from that point onwards to allow the surgeon to monitor and manually actuate the trigger switch **26** at the expiration of the is desired time period. Thereafter, the digital

display **62** may simply display or flash the compression time to the surgeon and the exact amount of elapsed time. It is appreciated that the instrument may provide a predetermined delay and then indicate that the instrument is ready to be manually fired, or alternatively the instrument may delay then indicate and then automatically fire.

Referring now to FIG. **6**, the surgical stapler **10** may alternatively have an analog display **64** disposed on the outer surface of the handle **14** which functions similar to the digital display **62**. Analog display **64** may have an audible alarm or alternatively have a flashing light to indicate that the appropriate tissue compression time has been reached or exceeded.

Referring now to FIG. **7**, there is shown a cross sectional view of the handle **12** of the surgical stapler along line **7-7** of FIG. **3**. In this embodiment, the surgical stapler **10** is a powered device and has a motor **66** with a driving mechanism. The driving mechanism is a drive output shaft **68**. Shaft **68** connects to a first gear **70**. The first gear **70** is connected to a second gear **72** which, in turn, engages an axial drive screw **74**. The motor **66** may be a device that drives one or more components of the surgical stapler **10**.

The drive screw **74** is a threaded rod having a number of helical grooves that are intended to rotate and contact another member to actuate the stapling cartridge **21** in the distal location of the surgical stapler **10** once compression is made by the surgeon using the clamp or jaws **21**, **22**. The axial drive screw **74** is disposed in toothed engagement through a central bore **76** of the second gear **72**. The axial drive screw may also be disposed offset from the second gear **72** or in any other desired geared arrangement. Upon actuation of the motor **66**, the axial drive screw **74** rotates and traverses distally through the portion **16** of the surgical stapler **10** to engage the stapler cartridge **21** as is well known in the art. Alternatively, the surgical stapler **10** may have a drive piston or plunger instead of the axial drive screw **74** or a single drive mechanism to control both the anvil **22** and the stapling cartridge **21**. Such mechanisms are well known in the art and may be found in U.S. Pat. No. 6,330,965 B1 to Milliman, et al., U.S. Pat. No. 6,250,532 B1 to Green, et al., U.S. Pat. No. 6,241,139 B1 to Milliman, et al., U.S. Pat. No. 6,109,500 to Alli et al., U.S. Pat. No. 6,202,914 B1 to Geiste, et al., U.S. Pat. No. 6,032,849 to Mastri, et al. and U.S. Pat. No. 5,954,259 to Viola, et al., which are all herein incorporated by reference in their entirety.

The surgical stapler **10** may include a first switch **80**. Switch **80** is located in a fixed position of the handle as shown. The stapler **10** also has a second switch **82** disposed distally relative to the first switch **80** that is distal or near the path of the drive screw **74** in the first initial position **78**. Likewise, the second switch **82** in a second firing position **84** which is disposed distally from the first initial position and proximal or near the path of the drive screw **74**. Each of the first and second switches **80**, **82** is a limit switch, but alternatively may be any switch known in the art to change or toggle from a first position to a second position by a simple motion of the axial drive screw **74** traversing past or adjacent to the respective limit switch.

Once the axial drive screw **74** or a portion thereof traverses past the first switch **80**, the first switch communicates a signal to the controller **28** by lead **86**. The controller **28** thus illuminates the indicator **36** or a portion thereof by lead **88** to indicate to the surgeon a first location of the axial drive screw **74**.

Thereafter, the drive screw **74** or a portion thereof traverses or contacts the second switch **82** at the second firing position **84**. The second switch **82** is also a limit switch and communicates a second signal to the controller **28** by lead **90** of the location or firing of the stapler cartridge **21**. The controller **28** then illuminates indicator **36** (or another portion thereof) by lead **88** to indicate to the surgeon that the stapling has been completed. At the conclusion of the stapling, the surgeon/operator will initiate retraction and then will reverse a direction of the motor **66** by lead **92**. The motor **66** then reverses operation and returns the axial drive screw **74** to the initial position **78** for the next stapling operation.

Alternatively, controller **28** upon receiving the first signal from the first switch **80** by lead **86** modulates one or more operations of the surgical stapler **10**. For example, in response to receiving of the first signal, the controller **28** can control one or more parameters of the surgical stapler **10** including tissue gap, speed of the motor **66**, control stroke of the axial drive screw **74**, axial drive screw travel distance, rotational rate of the axial drive screw and any combinations thereof.

Referring now to FIG. **8**, the surgeon may operate/engage the firing mechanism in order to actuate the stapling cartridge **21**. The firing mechanism actuates the motor **66** shown in FIG. **8**. The axial drive screw **74** commences rotation and by traversing past switch **80** the drive screw **74** actuates the first switch **80**. The first switch **80** outputs the signal to the controller **28** by lead **86**. The controller **28** in response to the signal from the first switch **80** then actuates the first light **40** by lead **92**. The surgical stapler **10** may further have a suitable structure in order to engage a stop feature. The stop feature prohibits overdrive of the drive screw **74**.

Thereafter, after the axial drive screw **74** traverses a predetermined distance to ensure tissue compression by the clamp or jaws **21**, **22**. The second switch **82** is actuated and outputs a second signal to the controller **28** by lead **90**. The controller **28** in response to the second signal illuminates the second light **42** by lead **94**. The second light **42** indicates that the stapling cartridge **21** has fired. The second switch **82** may further emit a signal to the controller **28** to reverse or cease motion in that direction of the motor **66** or to return the axial drive screw **74** to the initial position. The physician/operator may also manually reverse the direction of the motor **66**. A third light **44** may illuminate to indicate to the surgeon that the axial drive screw **74** is returning to the initial position **78**.

FIG. **8**A illustrates another embodiment of the present stapler. In the embodiment shown, the surgeon may operate/engage the firing mechanism in order to actuate the stapling cartridge **21**. However, the first switch **80'** is in a different location than the embodiment shown in FIG. **8**. In this embodiment, the first switch **80'** is located immediately under the lever **24** proximal to handle **14**. The switch **80'** in the embodiment of FIG. **8**A engages a tab **24'** disposed on the lever **24**. When the lever **24** is actuated and driven toward the handle **14**, the tab **24'** contacts switch **80'**, and the switch **80'** outputs the signal to the controller **28** by lead **86**. The controller **28** in response to the signal from the first switch **80** then actuates the first light **40** by lead **92**.

Thereafter, after the axial drive screw **74** traverses a predetermined distance to ensure tissue compression by the clamp or jaws **21**, **22**, the second switch **82** is actuated and outputs a second signal to the controller **28** by lead **90**. Again, the controller **28** in response to the second signal illuminates the second light **42** by lead **94**. The second light **42** indicates that the stapling cartridge **21** has fired. The second switch **82** that is actuated by switch **80'** may further emit a signal to the controller **28** to reverse or cease motion in that direction of the motor **66** or to return the axial drive screw **74** to the initial position. A third indicator **44** may be included to indicate to the surgeon that the axial drive screw **74** is returning to the initial position **78**.

FIG. **8**B shows still another embodiment wherein the first switch **80"** is located at still another location of the handle **14**, and on an opposite distal side of the lever **24** in proximity to pivot. Various configurations are possible and within the scope of the present disclosure, and switch **80"** may be placed in various configurations relative to the lever **24**.

FIG. **9** shows the surgical stapler **10** with a lever **24**. The lever **24**, shown in the elevated position, controls the clamp or jaws **21**, **22**, however this arrangement is not limiting and another driving member may control the clamp or jaws **21**, **22** such as the motor **66** (FIG. **7**). The lever **24** opens and closes the jaws **21**, **22** of the clamp to compress the body tissue prior to surgical stapling. The surgical stapler **10** further includes an electrical contact **96** with an electrically conductive member to complete a suitable analog or digital circuit. The electrical contact **96** is in a complementary nesting location of the lever **24** when the lever is in a lowered position or mating with the handle **14**. When the lever **24** is lowered from an elevated or raised position to the lowered position or contacting the handle **14**, the lever **24** engages the electrical contact **96**. The electrical contact may complete a suitable timer circuit of the display **62** when in the lowered position. In this embodiment, the electrical contact **96** commences the display **62**. The display **62** may count upwards from zero to a predetermined time limit, or may count down from an ideal predetermined tissue compression time interval. Once the displayed time reaches the predetermined time interval, an audible alarm **98** may sound. The audible alarm **98** provides the surgeon with a cue that the optimal tissue compression time has been reached, and that the firing mechanism should be actuated in order to fire the staple from the staple cartridge **21** to ensure a uniform staple formation.

FIG. **10** illustrates in still another embodiment where the clamp formed by jaws **21**, **22** is actuated by lowering the lever **24**. Contemporaneously, the timer circuit of the display **62** is activated by the electrical contact **96** on the lever **24**. The indicator **36** may be the linear display **50** which indicates a first color to prompt for the actuation of the stapling mechanism **21** by the trigger switch or button **26**. The display **50** may then display a second image or illuminate the number of segments corresponding to a travel path of the axial drive screw **74** as shown in FIG. **7**. Upon actuation, the second switch **82** outputs a signal to the controller **28**. The controller **28** then stops the motor **66**, and the controller outputs a control signal to the display **50** to modulate the display from the first color to another second color or from a first image to a second image to indicate that the stapling cartridge **21** has fired. Optionally, the controller **28** may further sound the audible alarm **98** indicating that the stapling cartridge **21** has fired. The alarm may be any sound or audible pattern, including a buzzer, a song, a chirp, a chime or any combinations thereof. Various indicator configurations are possible and within the scope of the present disclosure.

In still another embodiment, the jaws **21**, **22** may be actuated by lowering the lever **24**. Contemporaneously, the timer circuit of the display **62** is activated by the lever **24**. Thereafter, the indicator **36** indicates a first indication to prompt for an actuation of the stapling cartridge **21** by actuating switch **26** after a desired time period elapses. Once the trigger switch **26** is actuated, the controller **28** activates the motor **30**. The motor **30** then moves the drive screw **74** as shown in FIG. **7**.

As the axial drive screw **74** moves in an axial manner, the drive screw (or another plunger **100** connected thereto as shown in FIG. **11**) contacts a second member **102**. Second member **102** may be any member that modulates based on the motion of the plunger **100** and that can be detected or sensed by another device to provide an indication to the surgeon. The second member **102** may be a resistor strip which changes a resistance along a travel surface **104** of the plunger **100** as the plunger **100** or the axial drive screw **74** traverses along the portion **16** of the surgical stapler **10** (or other suitable travel surface location). The resistor strip **102** is coupled to indicator **36** such that the change in resistance of the resistor strip **102** selectively illuminates each of the lights **40** through **48** to signal an amount of travel by the axial drive screw **74** or the plunger **100** or other suitable drive member.

Alternatively, the resistor strip **102** may be coupled to another indicator **36** such as a linear display **50**. The display **50** may illuminate the number of segments **52**, **54**, **56**, **58**, and **60** corresponding to a travel of the axial drive screw **74** or the plunger **100** until the axial drive screw actuates the stapler is cartridge **21**. Upon actuated, the resistor strip **102** outputs a signal to the controller **28** which modulates the operation of the motor **66**, and sends another second signal to the display **50** to indicate that the stapling cartridge **21** has fired. The display **50** in response thereto may then display a suitable graphical image, another color, a textual message, or any other indication to indicate to the surgeon that the firing of the stapling cartridge **21** has concluded. Various indicator configurations are possible and within the scope of the present disclosure.

Referring now to FIG. **12**, in yet another embodiment of the present disclosure, the surgical stapler **10** may further include a non-contact sensor **106**. The non-contact sensor **106** may optionally be a so-called "Hall effect non-contact sensor" (or alternatively any other non-contact sensor) that is based in part on the physical principle of the Hall effect named after its discoverer E. H. Hall.

For example, end **108** of the axial screw **74** is directly connected, geared to, or offset from the motor **74**, and a cap like free end **110** of axial screw **74** contacts the stapler cartridge **21** to actuate the stapler cartridge and to fire the staple as discussed previously. The free end **110** of the drive screw **74** has a magnetic member **112** which connects thereto and which will not become dislodged by a rotation of the drive screw **74**. Alternatively, the magnetic member **112** may be disc shaped and simply connect to the free end **110**. In one initial orientation, free end **110** and the magnetic member **112** are disposed closely adjacent, or near to the non-contact sensor **106**. At this initial orientation, the magnetic member **112** is separated by a first distance "d" from the non-contact sensor **106**.

Once the trigger switch or button **26** is actuated, the motor **66** is actuated, and rotates, the drive axial screw **74** to traverse distally to actuate the stapler cartridge **21** as described above. In the second orientation after the motor **66** has been actuated, the magnetic member **112** moves and is a second distance "d" away from the non-contact sensor **106**. The second distance is any distance greater than the first distance "d". As the magnetic member **112** moves away from the non-contact sensor **106**, the non-contact sensor now located the second distance away from the magnetic field of the magnetic member **112** modulates an operation of the motor **66**.

The term "modulation" is defined as modulating amount of voltage received by the motor **66** in a dynamic manner, turning the motor "off" at a desired stroke, changing the motor speed, drive gear reduction of the motor, reduction of the axial drive screw pitch, or a change in the voltage or the current input of the motor, or changing another firing component, a change of the motor components and any combinations thereof. This may thereby slow the operation of the motor **66** to increase an amount of compression time of the body tissues between jaws **21**, **22**. In another alternative embodiment, the magnetic member **112** may be disposed on a suitable drive

piston instead of the drive screw **66**. As the drive piston travels away from the non-contact sensor **106**, a reduced or modulated amount of voltage may be provided to the motor **66**. Still further in another alternative embodiment, the non-contact sensor **106** may be placed at the free end **110** of the drive screw **74** and the magnetic member **112** fixed.

In another embodiment of the present disclosure, the surgical stapler may have a combined drive mechanism. The combined drive mechanism may control both a firing component of the stapling mechanism and a clamping mechanism. The surgical stapler **10** may, upon being actuated, has the drive mechanism advance to commence the clamping using the clamping mechanism and then hold and wait thus providing a predetermined delay. The surgical stapler **10** would then provide an indication to the surgeon/operator once a desired amount of compression is reached. Thereafter, the surgeon/operator would then actuate the drive mechanism after the time delay. The drive mechanism would then fire the staples from the stapling cartridge **21** into the compressed tissues and thus ensure a uniform staple formation. The surgical stapler **10** thus provides a time delay prior to stapling to ensure tissue compression.

Although being shown as an endoscopic surgical stapler, the present drive system may be used with any surgical stapling device known in the art, such as endoscopic surgical stapling devices, a pulmonary stapling device, a GIA surgical stapling devices, an endo-GIA stapling device, a TA surgical stapling device and any other stapler device for surgery know in the art. The present disclosure may also be used with a single drive surgical stapler that drives both the clamp and the stapling device. The present disclosure may be incorporated into a device that approximates and then fires such as with a TA surgical stapling device or with a surgical stapler without any such approximation of tissue.

It should be understood that the foregoing description is only illustrative of the present disclosure. Various alternatives and modifications can be devised by those skilled in the art without departing from the disclosure. Accordingly, the present disclosure is intended to embrace all such alternatives, modifications and variances. The embodiments described with reference to the attached drawing figures are presented only to demonstrate certain examples of the disclosure. Other elements, steps, methods and techniques that are insubstantially different from those described above and/or in the appended claims are also intended to be within the scope of the disclosure.

What is claimed is:

1. A surgical tool comprising:
- a handle assembly including a trigger;
- a cartridge configured to contain at least one fastener;
- an actuation member associated with the handle assembly and movable to urge the at least one fastener from the cartridge; and
- a controller delaying movement of the actuation member for a predetermined time period after activation of the trigger.

2. The surgical tool of claim **1**, further comprising an override switch located on the handle assembly and configured to interrupt operation of the controller.

3. The surgical tool of claim **1**, further comprising a dampening device, the dampening device modulating movement of the actuation member for the predetermined time period.

4. The surgical tool of claim **3**, further comprising:
- an anvil pivotally mounted in relation to the cartridge, the anvil being mounted for pivotal movement between an open position and a closed position; and
- a drive assembly including a body having a working end and a cam member, the cam member being positioned to translate relative to the anvil to maintain the anvil in the closed position during movement of the at least one fastener.

5. The surgical tool of claim **4**, wherein the dampening device delays movement of the actuation member such that tissue disposed between the anvil and the cartridge transitions from an uncompressed state to a compressed state.

6. The surgical tool of claim **1**, further comprising a motor configured to control movement of the actuation member, wherein the controller is configured to control the motor and delay the actuation member from urging the at least one fastener from the cartridge into tissue.

7. The surgical tool of claim **6**, wherein the controller is configured to slow operation of the motor to provide for the delay.

8. The surgical tool of claim **7**, further comprising a geared assembly, the controller configured to actuate the geared assembly to slow the operation of the motor to provide for the delay to compress the tissue.

9. A surgical tool comprising:
- a support body;
- a pair of jaws, the pair of jaws operably connected to the support body and at least one jaw is movable towards the other jaw;
- an approximation mechanism mounted to the support body and is configured for moving the at least one jaw;
- a drive mechanism; and
- a controller configured to control the drive mechanism, the controller delaying movement of the drive mechanism for a predetermined time period after actuation of the approximation mechanism.

10. The surgical tool of claim **9**, further comprising at least one fastener movable by the drive mechanism.

11. The surgical tool of claim **9**, further comprising a cartridge, wherein the cartridge is configured to contain a plurality of fasteners.

12. The surgical tool of claim **9**, further comprising an elongate body extending distally from the support body and defining a longitudinal axis.

13. The surgical tool of claim **9**, further comprising an override switch, the override switch being on the support body and configured to disengage operation of the controller.

14. The surgical tool of claim **9**, wherein the predetermined time period allows compression of tissue located between the pair of jaws to transition from a first state to a second state.

15. The surgical tool of claim **14**, wherein the tissue is uncompressed in the first state and compressed in the second state.

16. The surgical tool of claim **9**, further comprising a dampening device, the dampening device modulating movement of the approximation mechanism for the predetermined time period.

17. The surgical tool of claim **9**, further comprising a motor configured to control the drive mechanism and the controller configured to control the motor and delay the drive mechanism from moving at least one fastener into tissue.

18. The surgical tool of claim **17**, wherein the controller is configured to slow operation of the motor to provide for the delay.

19. The surgical tool of claim **18**, further comprising a geared assembly, the controller configured to actuate the geared assembly to slow the operation of the motor to provide for the delay.

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